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The competition situation analysis of shale gas industry in China: Applying Porter's five forces and scenario model

Wu Yunna, Yang Yisheng*

School of Economics and Management, NCEPU, 102206 Beijing, China

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ABSTRACT

With the increasing of energy demand and environmental pressure, China government has been exploring a way to diversify energy supply. Shale gas development is becoming an important energy strategy in China in recent years due to giant shale gas reserves. However, the shale gas market is preliminarily shaping in China, so that many factors have great influence on its competition. To find these factors and to control them rationally is good for the cultivating Chinese shale gas market. Five forces model for industry analysis puts an insight into the competitive landscape of shale gas market by showing the forces of supplier power, buyer power, threat of substitution, barriers to entry, and degree of rivalry. Illustrating the key factors that affect competitive landscape provides a view into the situation of shale gas industry. The variation tendency of shale gas industry is analyzed by setting various scenarios. Finally some suggestions are proposed in order to keep the development of shale gas industry positively.
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* Corresponding author. Tel.: +86 13401067697.
E-mail address: 8629823yys@163.com (Y. Yisheng).

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1. Introduction

Facing the pressure of resources and environment, many countries are developing new energy industry actively in the world. Shale gas (SG), as a new kind of natural gas, has received widespread concern [1]. Especially, that China fuels are chiefly polluting coal has leaded to the environmental deterioration or may further threaten the health of human life while it can deliver economic growth to developing China. Moreover, China overly dependence on oil and gas imported due to limited reserves of oil and gas. Energy security risk of China has been increasing over time [2,3]. Fortunately China with larger reserve of SG resources is expected to alleviate the above two problems effectively.

The SG resource is about two times of conventional natural gas resources in China, equivalent to nearly 100 billion tons of crude oil. It is mainly distributed in Sichuan basin (17.716×10^{12} m^3) [4], Tarim basin (6.113×10^{12} m^3), Junggar basin (1.019×10^{12} m^3), Songliao basin (0.453×10^{12} m^3), and another 6.283×10^{12} m^3 distributes in Yangzi [5], Jianghan and Subei districts [6–8]. Marine shale strata, sea–land-interaction strata and land-coal strata also have certain reserves [6]. Chongqing area and Sichuan basin located in the upper Yangtze region have the best development prospects [9]. However, Chinese SG resource is deep burial and most is situated in folds and faults areas bring great exploitation difficulty.

China government starts to develop SG in 2009. And it has experienced a wave of investment boom since 2012 [10,11]. However, Chinese SG market influenced by many factors is not mature, which is just in infancy stage, so that it may cause monopoly capital. In order to prevent monopoly and attract more investments, the government allowed the private enterprises to enter this industry in 2012. The winning enterprises found that there are still a variety of resistances to achieve SG commercialization, such as technology, policy and capital [12].

Nowadays, there are many enterprises in the SG industry, including state-owned company, private company and multinational petroleum company. The competition landscape of the SG industry changes fast in China. What are factors affecting Chinese SG industry? How do they affect the industry? What's the development trend? All of these are the core problems to be solved in this study. But comprehending the role of SG in the natural gas market is difficult due to the complex interactions of various forces. In this respect, using Porter's five forces model can provide a perspective on the SG industry and shed light on the myriad forces affecting SG market competition.

2. Porter's contribution to industry competition

In 1980, Michael Porter introduced a model of competitive strategy to explain an industry's position in a complex strategic environment. Porter's five forces model provides one way to present the current position of the SG industry which is called the potential stocks in the energy sources. The five forces presented in this model are the supplier power, the buyer power, the entry barriers to entry, the threat of substitution and the degree of rivalry [13]. Placing the industry of SG in a framework offers a unique insight into the bargaining position. This framework (see Fig. 1) sought to relate the average profitability of the participants in an industry to competitive forces. Given the impact of Porter's five forces framework on industry completion landscape, the framework in short is presented by Karagiannopoulos [14].

2.1. Force 1: Supplier power

The power of suppliers refers to the ability of bargaining power and controlling power of resources. The bargaining power of suppliers is the ability to raise prices. The controlling power of resources is reflected by the difficulty that other enterprises obtain this kind of resources. Suppliers are powerful if: suppliers have stable market position; products or services are unique so that the customers are hard to change suppliers or cost of changing suppliers is high; suppliers are easier to form strategic alliances.

2.1.1. Force 2: Buyer power

Buyers can threaten the industry by bargaining down prices or raising the costs by demanding better quality. The most important determinants of buyer power are the size and the concentration of customers. Buyers are powerful if: buyers are fewer but they need to buy many products; buyers need standard products which can be purchased from different suppliers; buyers are easier to form strategic alliances.

2.1.2. Force 3: Barriers to entry

New competitors may trigger fierce market competition. Fierce market competition may decrease profit level or endanger some enterprises' survival. Threat of potential entrants is reflected by two factors: barriers to entry and reaction of enterprises in the industry with new entrants. The most common forms of entry barriers, except legal obstacles or government policy, are usually the scale and the investment required to enter an industry as an efficient competitor.

2.1.3. Force 4: Threat of substitutes

The threat that substitute products pose to an industry's profitability depends on the relative price-to-performance ratios of the different types of products or services to which customers can turn to satisfy the same basic need [14]. The lower price or better quality, the stronger competitiveness the substitutes have.

2.1.4. Force 5: Degree of rivalry

Intense rivalry among established companies constitutes a strong threat of profit-ability. The intensity of rivalry is relevant to the presence of various factors such as industry competitive structure, industry demand and capacity to meet the demand, differentiation among companies, and the height of exit barriers [15].

Porter's five forces model has been widely applied to analyze industry competition in various markets. For example, Akcagun and Dal analyzed Turkish apparel industry by using Porter's five forces model. And a number of strategies were recommended to Turkish apparel industry to adopt for the competition [16]. Sumpio used the Porter's five forces analysis to identify the sources of competition, the

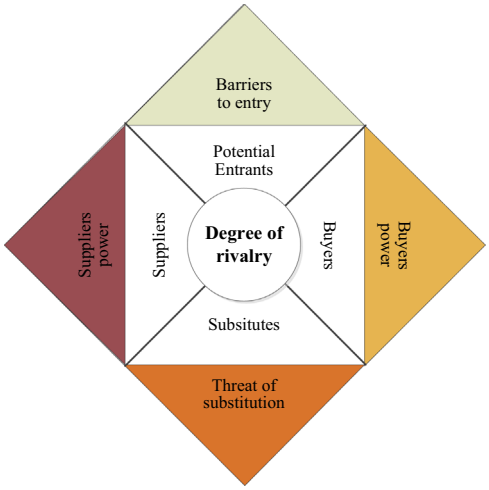

Fig. 1. Porter's five forces model.

strength and likelihood of that competition existing, and barriers to competition in vascular surgery hospital. The results helped them to understand both the strength of current competition and the strength of a position that their specialty needs to move to [17]. Ucmak and Arslan prepared questions about new market entrants in Istanbul hotel industry based on Porter's five forces model [18]. And the mobile third party payment competitive strategy is also analyzed by five forces model [19]. It can be inferred that the five forces model has advantages in industry competitive analysis.

3. Shale gas industry analysis in China applying Porter's five forces model

3.1. Supplier power

Chinese gas resource is monopolized by few large state-owned enterprises. Before 2012, natural gas market share was held by two gigantic enterprises: CNPC accounting for about 80% and CPDC accounting for about 10%. But from the perspective of the change of bidding policies, the government may be more willing to break the monopoly.

China's constitution stipulates that land and the underground resources are owned by the state. Therefore, SG resources as the national resources belong to the country. Enterprise just can obtain the mining right through bidding and tendering. Therefore, SG suppliers are affected by the Chinese government policy greatly. If enterprises want to enter SG industry, they should have strong capital or technological strength and be recognized by government.

This paper analyzes the main differences of tendering and bidding of SG exploitation rights in 2011 and 2012. It can reflect the situation of supplier power. Table 1 lists the tendering and bidding situations of two bidding rounds in China. The number of tendering blocks is increased from 4 to 20. State-owned enterprises are only allowed to participate in bidding for the first tendering in 2011. Six invited state-owned enterprises submitted a total of nine tenders. Each block has 2.25 bidders averagely. But two tendering blocks has no bid-winning enterprises because the tenders are less than three enterprises. The situation for the second tendering in 2012 is better than the first tendering because Chinese government allows private enterprises to enter this industry. A total of 83 enterprises participated in the bidding and submitted 152 copies of the tenders. Each block has 7.6 bidders averagely, which is higher than the first bidding. The private enterprise is allowed to enter to SG tendering and 27 private

Table 1
Comparison of tendering and bidding situation.
Source: web of Cleantech China (http://www.china5e.com/news/news-258350-1.html).

Year	SG blocks	Tender enterprises			
		State-owned enterprises	Private enterprises	Ratio of state owned enterprises (%)	Ratio of private enterprises (%)
2011	4	6	0	100	0
2012	20	56	27	68	32

Table 2
Comparison of bid-winning situation.
Source: web of Cleantech China (http://www.china5e.com/news/news-258350-1.html).

Year	SG blocks	Bid-winning enterprises			
		State-owned enterprises	Private enterprises	Ratio of state-owned enterprises (%)	Ratio of private enterprises (%)
2011	4	2	0	100	0
2012	20	18	2	90	10

enterprises more than 32% participated in. Two of private enterprises (10%) won the exploration rights (shown in Table 2).

With contrast to the fierce competitions of bidding is wait-and-see attitude of some winning enterprises. They treat the further investment to development SG resource with more cautions. The paper indicates that the main reasons of this phenomenon are immature technology and huge investment risk. Unforeseen costs may continue arise because of immature technology. And the investment income has big uncertainties. Therefore, these enterprises generally tend to wait technology development and cost reduction. If the technology is matured or there is a successful case in China, they may accelerate their investments.

Initial news of a possible Compensated Transfer Mechanism will come for the third tendering, in order to reduce risk of winning enterprises. In other words, government tries to help enterprises to do some primary works for sharing the risk of SG exploitation. Then enterprises repay relative exploitation cost to the government. In details, the government will do the preliminary seismic and drilling exploitation to confirm gas reserves and relative data. The enterprises should repay the cost to the government after winning the rights. However, the planed third tendering of SG by the end of 2013, has not been hold until July, 2014 for a variety of reasons.

The competitors in SG investment have changed with development of national policies according to the results of two tendering exercises. That private and foreign enterprises begin to enter this industry makes the SG market more competitive.

3.2. Buyer power

Buyer power is a factor that impacts competition industry. If there is only one purchaser in the industry, the buyer will have huge power. In this case, the buyer can affect the price [20]. In turn, if there are many purchasers, the buyers may stay in weak place. We can obtain the buyer power through the analysis of the consumption structure and consumers' characteristics.

3.2.1. Natural gas consumption in China

With the gradual improvement of infrastructure in recent years, demand of natural gas keeps the explosive growth in China.

Consumption of natural gas increased slowly before 1996. The construction activities of long gas-pipeline stimulate consumption growth after 1996. It consumed twice as much gas energy in 2006 as that in 1996. The consumption showed annual growth of 100×10^8 m^3 (m^3) when the West-east Gas Transmission project was used after 2004. In 2008, the natural gas consumption in our country almost reached 78×10^9 m^3, to triple the consumption in 2000. And it exceeds 1070×10^8 m^3 in 2010, 1475×10^8 m^3 in 2012 and 1676×10^8 m^3 in 2013.

Fig. 2 shows that the annual consumption of gas has kept increasing since 2000. The proportion of natural gas in primary energy production has been keeping quick growth in China since 2008, even though the growth rate fluctuates in a range. The growth of gas consumption keep increasing before 2008 and it becomes more volatile after 2008, which is related energy policy, climate and gas price.

The proportion of natural gas in primary energy kept 2% to 3%. It increased to 3.8% in 2008, and 5.8% in 2013, respectively. The gas proportion of natural gas in primary energy still has room for further upward swing because it is still less than average. According to Chinese energy planning, this proportion will reach to 8%.

But another group of data reflects a potential problem hidden behind the rapid growth. China's natural gas consumption reached 1676×10^8 m^3 in 2013. About 1146×10^8 m^3 gas is produced in the domestic. However, more than 530×10^8 m^3 natural gas, a quarter of the total, needs to import from the other countries. The degree of external dependence of natural gas breaches 30% for the first time and reaches 31.6%. It increased the risk of energy security in China undoubtedly. So it is a significant reason that Chinese government is active to develop SG industry.

Russia and China signed a supply contracts in June 2014. The agreement stipulated that Russia will sell 380×10^8 m^3 natural gas to China every year for 30 years. This agreement increases reliability of natural gas input in a medium term. This agreement makes SG development becoming less urgent. However, from the perspective of long term, China's energy strategy still needs to focus on new energy development.

Another factor that affects the gas consumption is environment pollution. Pollution haze is becoming one of biggest concerns for Chinese people and government so that many measures are taken by officials to alleviate air pollution. Chinese government encourages enterprises to reduce the burning of fossil fuels and increase the using of clean natural gas. In conclusion, natural gas consumption growth trend would be even more significant.

3.2.2. *The consumption structure (buyers) of natural gas*

The consumption structure reflects the condition of the buyers. Natural gas consumption is divided into four parts: electricity, urban gas, industrial fuel, chemical raw materials. In electricity industry, natural gas is used for load-peak adjustment and

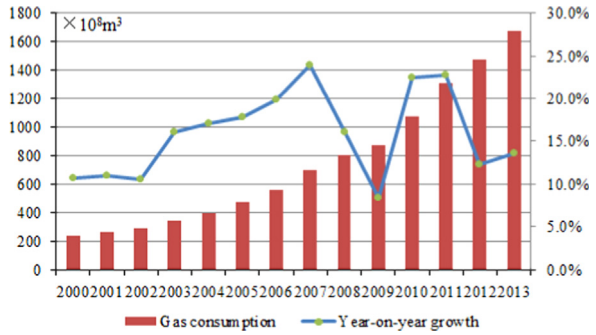

Fig. 2. Natural gas consumption in China.
Source: China energy statistical yearbook.

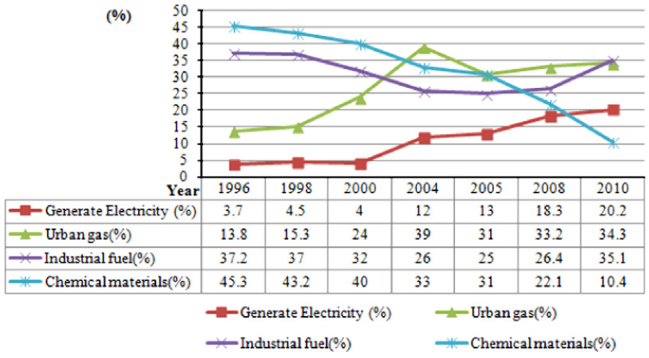

Fig. 3. Consumption structure of natural gas.
Source: China energy statistical yearbook.

cogeneration systems. A part of gas, called urban gas, is consumed by residents (cooking, heating the water, hanging furnace heating etc.), business buyers (hotels, schools, restaurants, bath, etc.), CNG vehicles (buses, taxi, municipal car, etc.), centralized heating etc. The gas is also used as industrial fuel in metallurgy, steelmaking (special steel), Pottery firing etc. It is also used as chemical raw materials to make methanol, chemical fertilizer and hydrogen manufacturing etc.

The consumption structure and its development trends are shown in Fig. 3. We can conclude that the consumption structure is optimized gradually with the increasing of electricity and urban gas from the figure. It can be found that the proportion of urban gas exits fluctuation from 2004 to 2005. Because urban gas was largely used in 2004, the proportion increased quickly in 2005. Then, it became steady from 2005 to 2010.

We can analyze the buyers' power from natural gas consumption structure. Obviously, domestic production of natural gas cannot meet market demand. Under this supply-demand environment, the suppliers are still in a dominate position and the buyers are powerless relatively. The consumption structure represents the different types of buyers. The power plants and residents will become the main buyers of SG in the future. However, the power of various buyers has great differences. The individual resident buyers who cannot impact the SG prices have small power. And they can only accept the gas price and its fluctuation passively. Fortunately, natural gas is related to national economy and people's livelihood, the government will invite some representatives of buyers to take part in the hearing meeting to limit the enterprise actions when the price is changed dramatically. All in all, if gas price keeps lower than liquefied gas, the residents are still willing to accept the fluctuation. Power plants as the big clients usually have the ability of price negotiation with suppliers. Therefore buyers of electric power plant have relatively strong power.

3.3. *Barriers to entry*

The theory behind barriers to entry is that suppliers not only compete with other suppliers, but they run the risk of new entrants into the SG market. In the traditional model of pure competition, additional players will enter the market until the profits are nominal and the risk is predicable, unless there are specific barriers to entry. The most obvious barriers to entry may be technology, policy and financial barriers.

3.3.1. *Technology barrier*

At present, the biggest developing barrier of SG in China is technology barrier. SG industry in China is just getting started nearly eighty years later than United States [21]. China is lack of own proprietary exploitation technologies, like hydraulic fracture

and the formulas of drilling fluid. Furthermore, it is difficult to use overseas technologies without improved because of the subsurface structure and burial depth in Chin [22–26]. Therefore, the technology barriers limit the entrance of enterprises.

3.3.2. Policy barrier

Policy is a very powerful force to limit enterprises to enter this industry, seeing from bidding and tendering results in 2011 and 2012. In addition, the mining rights of conventional oil and gas is usually about 10 years, however, the SG exploitation rights is just 3 years. In other words, if the enterprises cannot complete the contracted exploitation within three years as financial or technical problems, government may withdraw the exploitation. It means that the hefty upfront investments may lose. Therefore, the winning enterprises should continue investment and exploitation every year. The policy will increase the enterprises' risk undoubtedly.

3.3.3. Financial barrier

The financial barrier is the third kind of barriers. China's SG industry has been invested more than 1150.8 million USD. In total of more than 80 vertical wells and 20 horizontal wells are drilled. It is still miles off being commercial production. However, the existed SG subsidy policies are all based on the gas production. If there is no gas production, the enterprises will not receive any subsidy. So the enterprises need longer time to withdraw the capital investment. The economic risk is very huge.

Furthermore, the market withdrawal mechanism is still not formed in China. The winning enterprises cannot transfer the rights to other enterprises. It is different from the policies of United States, which can sell the SG exploitation rights for recovery the cost rapidly. The Chinese government is actively exploring effective withdrawal mechanism, but the implementation of this policy still needs time.

Fortunately, it will attract more capital to get into SG industry and decrease financial barrier as the government subsidies. The SG enterprises can receive subsidies from both central government and local government in China. Central government gives subsidies to SG enterprises as much as 0.4 Yuan/m^3 (almost 6.45 cent/m^3). In order to elaborate the supportive efforts of government, we compare the subsidy policies of SG and coal-bed methane (CBM). The central government's subsidy of SG in China is two times higher than the subsidy of CBM (see Fig. 4). However, the technology of CBM is fairly mature and the productivity is higher than shale gas. Enterprises of CBM have much easier to obtain subsidies. For example, Finance Ministry of Shanxi province will give a subsidy of 0.05 Yuan/m^3 to local coal-bed methane enterprises. Then, CBM's comprehensive subsidy can reach 0.33 Yuan/m^3 adding other tax breaks. From subsidies comparison, SG industry is given more subsidy than CBM through fiscal or tax favorable policies.

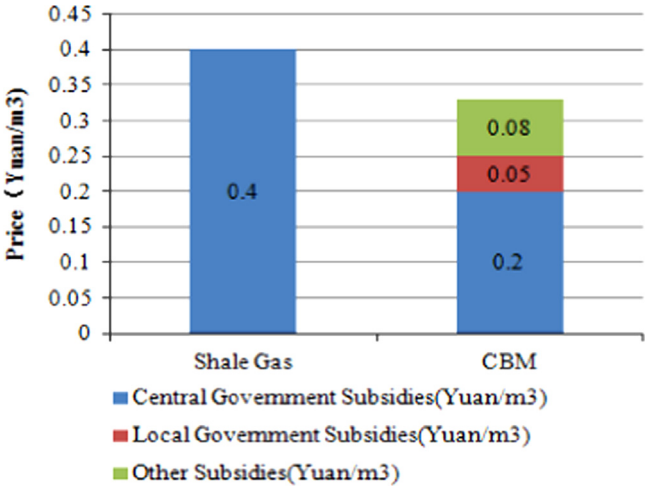

Fig. 4. Comparison of SG and CBM subsidy policy.
Source: China Treasury and energy bureau in document (2012) 847.

3.4. Threat of substitution

We need to analyze the substitution relationship between final production of SG and the other energies when we analyze the threat of substitution.

3.4.1. Wind power

Wind power has developed quickly in China. Its capacity is near security capacity that the grid can accommodate. And wind power is mainly used for adjusting the peak-load of electricity. So the wind power can substitute the SG in power generating part. The other functions of SG cannot be substituted by wind power. Furthermore, natural gas is easier to use for power plants. And the peak adjustment of wind power needs reasonable scheduling of grid.

3.4.2. Solar power

The installed capacity of solar power is still small in China. It can replace the gas for power generation in a certain extent. Some small capacity of solar equipment, such as solar-home-system and solar car, can partly replace urban gas. But most people will choose to natural gas at present as limited by the installed capacity and cost of solar power.

3.4.3. Nuclear power

Nuclear power is an important energy to instead of coal. However, the safety of nuclear power is questioned all over the world after the radiation leak issue at the Fukushima Daiichi nuclear plant. Many countries stopped the development plans of nuclear power. Therefore, nuclear power will pose no threat to gas market recently. If the government vigorously promotes the development of nuclear energy in the future, it will form strong substitute of natural gas that is used as electricity and urban gas (if the price of electricity is lower than

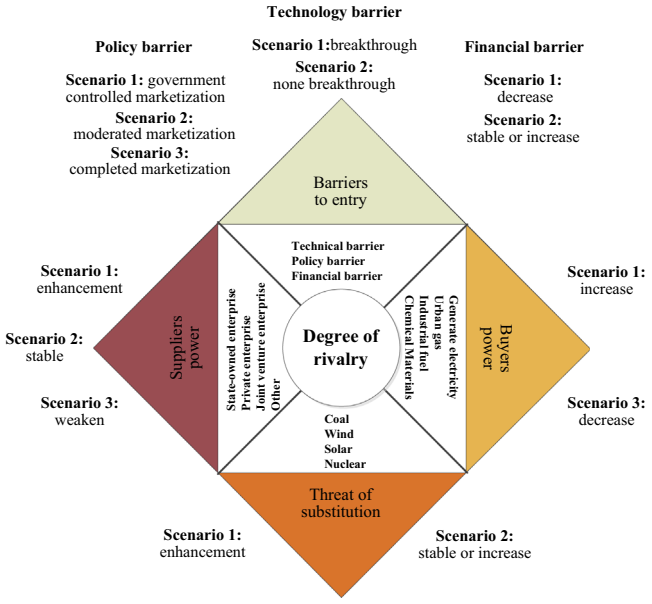

Fig. 5. SG competitive landscape based on five forces model.

the gas, the residents may choose to use the electricity for cooking or heating.).

3.5. Degree of rivalry

At the present stage, the provision of SG, unlike many other specialties, has a relatively low degree of internal rivalry. SG industry is monopolized by large state-owned oil and petrochemical enterprises in China before 2012. In order to attract more capital to research, Chinese government opens the investment round to a variety of capital styles. But the competition intensity is still relatively weak because of three kinds of barriers analyzed above. In general, the competition degree is increasing with the liberalizing of the SG market gradually. The degree of rivalry will remain steady for some time until some factors changed.

According to the analysis above, we can summarize and develop the five forces model of SG industry with more details (see Fig. 5). The degree of rivalry is affected by the other four parts.

4. Shale gas development trends in China based on scenario analysis

The competition landscape of Chinese SG industry is analyzed and four forces have influence on industry competition. So what might these forces be doing to Chinese SG industry? This paper studies industry competitive changing trends based on various scenarios. Scenario setting is shown in Fig. 5.

4.1. Scenarios of supplier power

Scenario 1: Supply capacity of conventional gas gets enhanced. The strong supply capacity of conventional gas has simply crowding out effect to SG because the conventional gas has lower cost and its technology requirement is relatively lower. When the supply capacity gets stronger, the degree of rivalry of SG industry will sustain or weaken at current levels. The conventional gas is divided into two kinds: self-sufficiency and foreign-import. Over-reliance on foreign gas imports will bring risks to national energy security. Especially, the external dependency of gas is over 30% in 2013, so the exploration research of SG will not stop.
Scenario 2: Supply capacity of conventional gas keeps stable. If the gap between demand and domestic supply is not so large, investment of SG may slow down and the degree of rivalry will decrease when the supply keeps stable. If the demand of gas is continuously growing, investment of SG may increase fast and degree of rivalry will increase.
Scenario 3: Supply capacity of conventional gas gets weakened. If the supply capacity gets weakened, investment of SG and the degree of rivalry may both increase as long as the demand doesn't drop off.

4.2. Scenarios of buyer power

Scenario 1: Demand of natural gas increases. This scenario is consistent with actual situation. The increase of demand, natural gas enterprise can obtain more profit from gas selling. So demand increase is fundamental motivation of investment. If the demand increases, the investment will increase and the degree of rivalry will increase when the gas supply is not enough.
Scenario 2: Demand of natural gas keeps stable. When gas demand remains stable, supply of gas meets requirements as the current state, so that the investment will slow down and the degree of rivalry will keep balance or slight declines.
Scenario 3: Demand of natural gas decreases. When gas demand decreases, supply of gas will be forced down. The excess capacity may slow down investment and the degree of rivalry will declines.

4.3. Scenarios of barriers to entry

Many factors have influence on SG market competition. This paper illustrates the trends of competition under different market scenarios.

4.3.1. Scenarios of policy barrier

Scenario 1: Government controlled marketization. Before 2012, the government controlled the market competition. The government can choose the market competitors through tendering and bidding policies. The market will be monopolized by some invited companies that have strong strength. This mode is only suitable for the initial stage of SG market.
Scenario 2: Moderated marketization. The government allows enterprises to enter the industry after setting a series of competition rules. At this time, the degree of rivalry increases because of the competitors' entrance. But the government also can limit some transactional behaviors. This pattern can be used when the strength gap of competitors is still big. In that way, weak competitors can be protected. It is good for forming SG market.
Scenario 3: Completed marketization. The government interaction to the industry may be weakened greatly in this stage. The entry and exit to this industry are absolutely corporate behaviors. The competition may be changed according to the industry's profitability, earnings outlook. This pattern is suitable for the situations that the weak enterprises have finished the accumulation of technologies and capital. Then they can compete with the large companies.

4.3.2. Scenarios of technology barrier

Scenario 1: Exploration technologies of SG have breakthroughs. The technology barrier is direct factor which affects SG investment. Immature technologies make it hard to exploit SG resource and the risk is huge. If the exploration technologies have breakthrough, investment income will be determined and investment risk will significantly drop. Investment will increase and degree of rivalry will also increase.
Scenario 2: Exploration technologies of SG have no breakthrough. If relative technologies have no breakthrough, most enterprises will essentially drop out, except some large monopoly enterprises investment for national and enterprises strategies. Even if some enterprises obtain SG explor ationright, they may slow down the investment to further exploit.

4.3.3. Scenarios of financial barrier

Scenario 1: Exploitation cost decrease. If exploitation cost decreases, profit of enterprises will increase. Then investment will increase and degree of rivalry will increase.

Scenario 2: Exploitation cost stable or increase. If exploitation cost increases, investment will decrease and degree of rivalry will decrease.

4.4. Scenarios of threat of substitution

Scenario 1: Supply capability of clean energy enhancement. Enhancement of supply capability of clean energy may decrease demand of natural gas in certain extent. However, the clean energy mainly substitutes the fossil energy which influence environment like coal and oil. From this perspective, clean energy may affect investment of SG and decrease industry competition slightly. From the perspective of cost, when the cost of clean energy is lower than SG exploration, investment may flow to clean energy. It may slow down investment of SG and decrease the degree of rivalry.
Scenario 2: Supply capability of clean energy stable or reduce. If supply capability of clean energy keeps stable or reduces, in order to protect environment, government may take some measures to encourage SG investment. So the degree of rivalry may increase.

In conclusion, this paper makes brief predict based on situation and relative information of SG industry. In general, the competition degree is increasing with the liberalizing of the SG market gradually. The degree of rivalry will remain steady for some time until some factors changed.

Following factors are the most influential to competitive situation of SG industry: Breakthrough of SG exploitation technologies makes the commercial extraction become a reality and the mining economy can be further defined. The investment risk will decrease, so that the competitors increase. Finally, the competitive intensity will increase. Government management policies of SG can affect market competition directly. The Chinese government is making efforts to commercialize the SG industry by reducing the administrative intervention. Enterprises consider the economic benefits and risk level as the most significant decision-making factors. So the economic and risk factors affect the enterprise behaviors directly and affect the market competition indirectly.

5. Conclusions and suggestions

Rich SG reserves in China could replace some primary energy effectively to reduce environmental risk. It also can reduce the dependence on imported energy, which may decrease the risk of national energy security.

Analyzing the SG industry by using five forces model makes it clear that SG suppliers are in a precarious economic position in the current SG market of China. This paper analyzes the SG industry in China from five aspects: supplier power, buyer power, barriers to entry, threat of substitution and degree of rivalry. In addition, we find four principal factors influencing the SG industry structure in the future: technology, policy, economic and risk elements. SG competition will be obviously changed with these factors: (1) The competition is becoming fierce after the government permits private companies to enter the SG industry in 2012. (2) The buyers are divided into four parts. The proportion of electricity and urban gas consumers is increasing gradually, and the other parts are declining steadily. Various buyers have different influences on market price. (3) Although the government allows private companies to get into the field, the technology, policy and capital barriers are still existing in SG field. (4) The SG has a substitution effect on the coal and oil. Wind, solar and nuclear energies may replace small parts of power-generating gas. If the government quickens the development steps of nuclear power, it will become a threat to SG industry as an effective substitution.

This study further illustrates the influence trends from various forces in five forces model based on competitive situation of SG industry at current stage, then an experience judge of SG industry is given in this study based on actual situation and information.

We present the development suggestions of SG industry according to the results. (1) Strengthen policy guidance. The policy guidance includes making development planning and giving reasonable subsidies [27]. Government should scientifically evaluate and analyze SG resource potential and make mid-term and long-term development planning. The reasonable subsidy policy also can ensure the development of SG industry healthily and orderly. (2) Increase input of relative technology research. China should strengthen international communication and cooperation to introduce more advanced technologies. It also needs to strengthen the independent research of the SG drilling technology to meet the special geological conditions in China. Furthermore, environmental protections, such as water protection and earthquake prevention, should be considered [28]. The emergency mechanism of abrupt pollution needs to be made before SG exploitation. (3) Emphasis on the accumulation of experience. The government should pay attention to experience accumulation, to make relevant technical standards as soon as possible. Enterprises should accumulate the management experience of exploitation and operation to reduce waste of resources. (4) Reduce the production cost. During the exploitation process, the cost composition should be carefully analyzed. Then we should try to reduce the cost through technical and management improvement. Then enterprises can improve the profits and shorten the pay-back period. (5) Research reasonable market withdrawal mechanism. Incomplete market withdrawal mechanism will surely increase the capital investment risk [29]. Many developed countries have good practical experience for enterprises to withdraw like the United States. Chinese market needs reasonable market withdrawal mechanism combined with its special conditions. It will be very helpful for the market.

Acknowledgements

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